OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **SUNSET LAKE, GREENFIELD** the program coordinators recommend the following actions.

FIGURE INTERPRETATION

- Figure 1: These graphs illustrate concentrations of chlorophyll-a in the water column. Algae are microscopic plants that are a natural part of lake ecosystems. Algae contain chlorophyll-a, a pigment necessary for photosynthesis. A measure of chlorophyll-a can indicate the abundance of algae in a lake. The historical data (the bottom graph) show a *fairly stable, but seasonally variable,* in-lake chlorophyll-a trend. The chlorophyll concentration returned to a normal level this season, possibly as a result of increased rainfall. Algal abundance peaked in July but decreased again in August. Mean chlorophyll concentrations were the lowest the lake has experienced since 1991, and were well below the state mean. While algae are present in all lakes, an excess amount of any type is not welcomed. Concentrations can increase when there are external and internal sources of phosphorus, which is the nutrient algae depend upon for growth. It's important to continue the education process and keep residents aware of the sources of phosphorus and how it influences lake quality.

- Figure 2: Water clarity is measured by using a Secchi disk. Clarity, or transparency, can be influenced by such things as algae, sediments from erosion, and natural colors of the water. The graphs on this page show historical and current year data. The lower graph shows a *stable* trend in lake transparency. Lake transparency was high in August this season, and the bottom depth at this sampling site was deeper than previous sites. The slight decrease in July transparency was likely a result of the breezy conditions and ripples on the water's surface. The average transparency at Sunset Lake was above the state mean. The 2000 sampling season was considered to be wet and, therefore, average transparency readings are expected to be slightly lower than last year's readings. Higher amounts of rainfall usually cause more eroding of sediments into the lake and streams, thus decreasing clarity.

- Figure 3: These figures show the amounts of phosphorus in the epilimnion (the upper layer in the lake) and the hypolimnion (the

lower layer); the inset graphs show current year data. Phosphorus is the limiting nutrient for plants and algae in New Hampshire waters. Too much phosphorus in a lake can lead to increases in plant growth over time. These graphs show a *fairly stable* trend for epilimnetic phosphorus levels, and a *slightly improving* trend for the hypolimnetic concentrations. Phosphorus concentration in both layers increased slightly from 1999. August results were higher in both layers and it was noted that it was raining during sampling. Watershed runoff likely caused an increase in phosphorus being flushed into the lake. With the exception of epilimnetic phosphorus concentration in 1996, mean phosphorus concentration has remained below the median for New Hampshire lakes for over 10 years in both layers. One of the most important approaches to reducing phosphorus levels is educating the public. Humans introduce phosphorus to lakes by several means: fertilizing lawns, septic system failures, and detergents containing phosphates are just a few. Keeping the public aware of ways to reduce the input of phosphorus to lakes means less productivity in the lake. Contact the VLAP coordinator for tips on educating your lake residents or for ideas on testing your watershed for phosphorus inputs.

OTHER COMMENTS

- Conductivity appears to be increasing throughout the watershed over the years (Table 6). The greatest increase occurred at the Inlet, although the turbidity was also high during the July and August sampling events. It is possible the Inlet was stagnant or had low flow, and sediment may have entered the sample bottle. However, we suggest conducting a more stringent sampling of the Inlet in 2001. Consider collecting samples at several sites along the Inlet where there are high waters and good flow. Also, collecting samples during the spring snowmelt or a rainstorm will help to determine the sources of the increased conductivity. Contact the VLAP Coordinator this spring for more ideas. Conductivity increases often indicate the influence of human activities on surface waters. Septic system leachate, agricultural runoff, iron deposits, and road runoff can all influence conductivity.

- The total phosphorus concentration of the Inlet was also slightly elevated this summer, although not to an excessive level. We will continue to observe the water quality of the Inlet.

- A dissolved oxygen profile was not conducted this year due to windy conditions. Please be sure to contact the VLAP Coordinator this spring to schedule our annual visit so we can attempt this test again.

- *E. coli* originates in the intestines of warm-blooded animals (including humans) and is an indicator of associated and potentially harmful pathogens. Bacteria concentrations were low at the site tested (Table 12). If residents are concerned about septic system impacts, testing

when the water table is high or after rains is best. Please consult the Other Monitoring Parameters section of the report for the current standards for *E. coli* in surface waters.

NOTES

- Monitor's Note (7/18/00): Rain earlier in afternoon.
- Monitor's Note (8/23/00): Rain during sampling; construction of house occurring on shore.

USEFUL RESOURCES

Answers to Common Lake Questions, NHDES-WSPCD-92-12, NHDES Booklet, (603) 271-3503.

Septic Systems and Your Lake's Water Quality, *WD-BB-11*, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

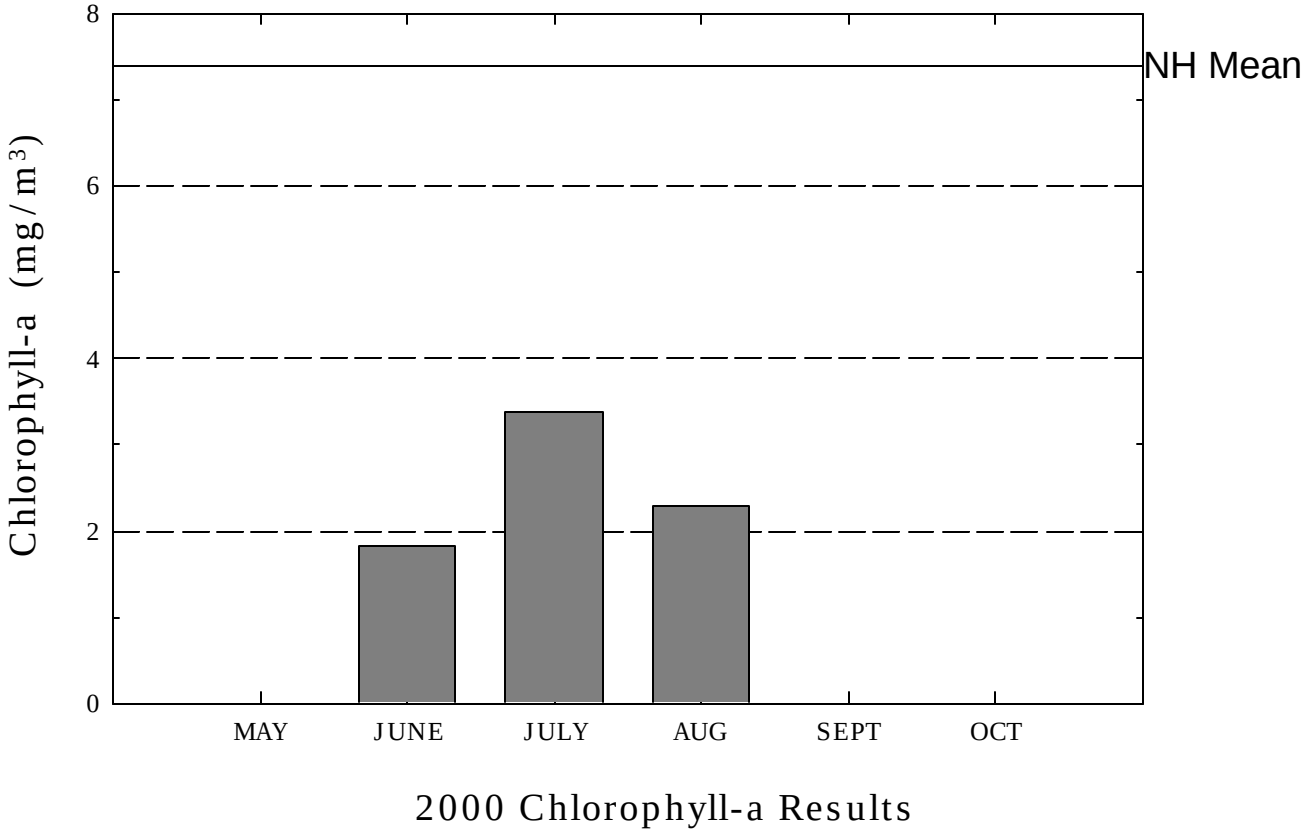
Effects of Phosphorus on New Hampshire's Lakes, NH Lakes Association pamphlet, (603) 226-0299 or www.nhlakes.org

Road Salt and Water Quality, *WD-WSQB-7*, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

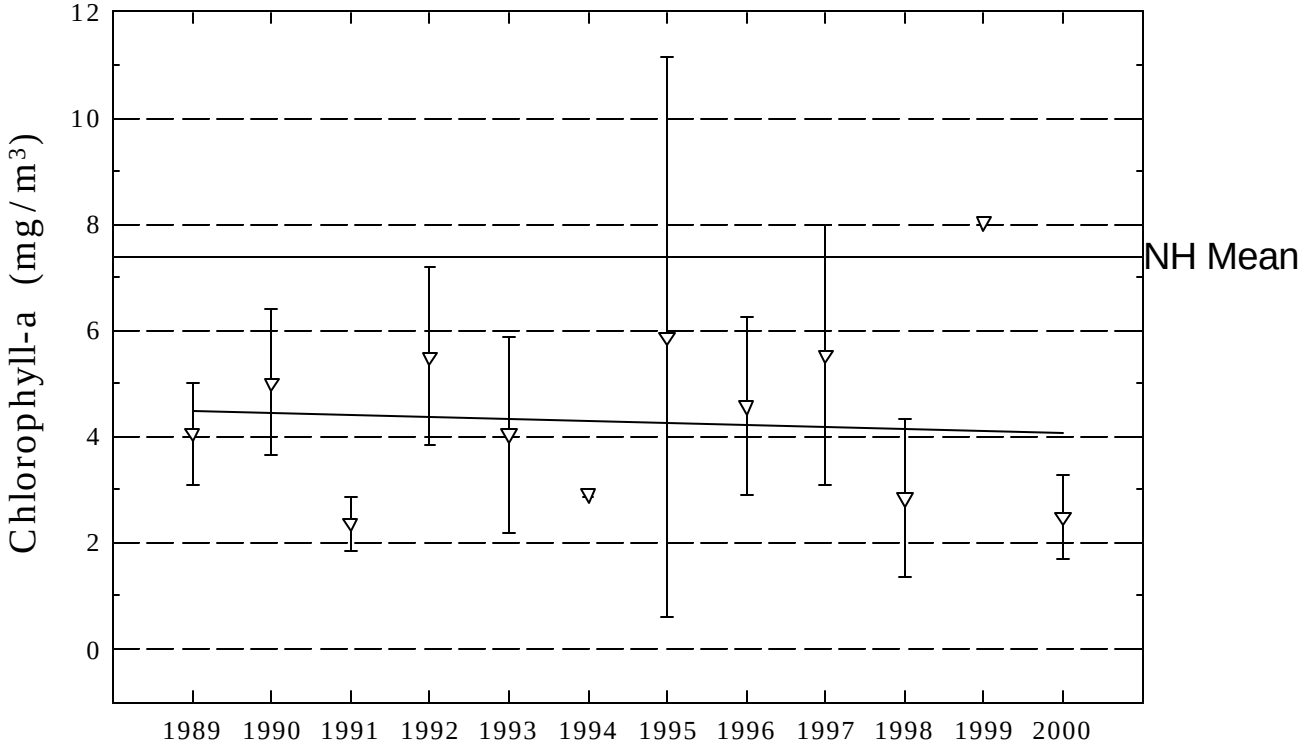
Water Sampling Protocol for E. coli Testing, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

Sunset Lake, Greenfield

Figure 1. Monthly and Historical Chlorophyll-a Results



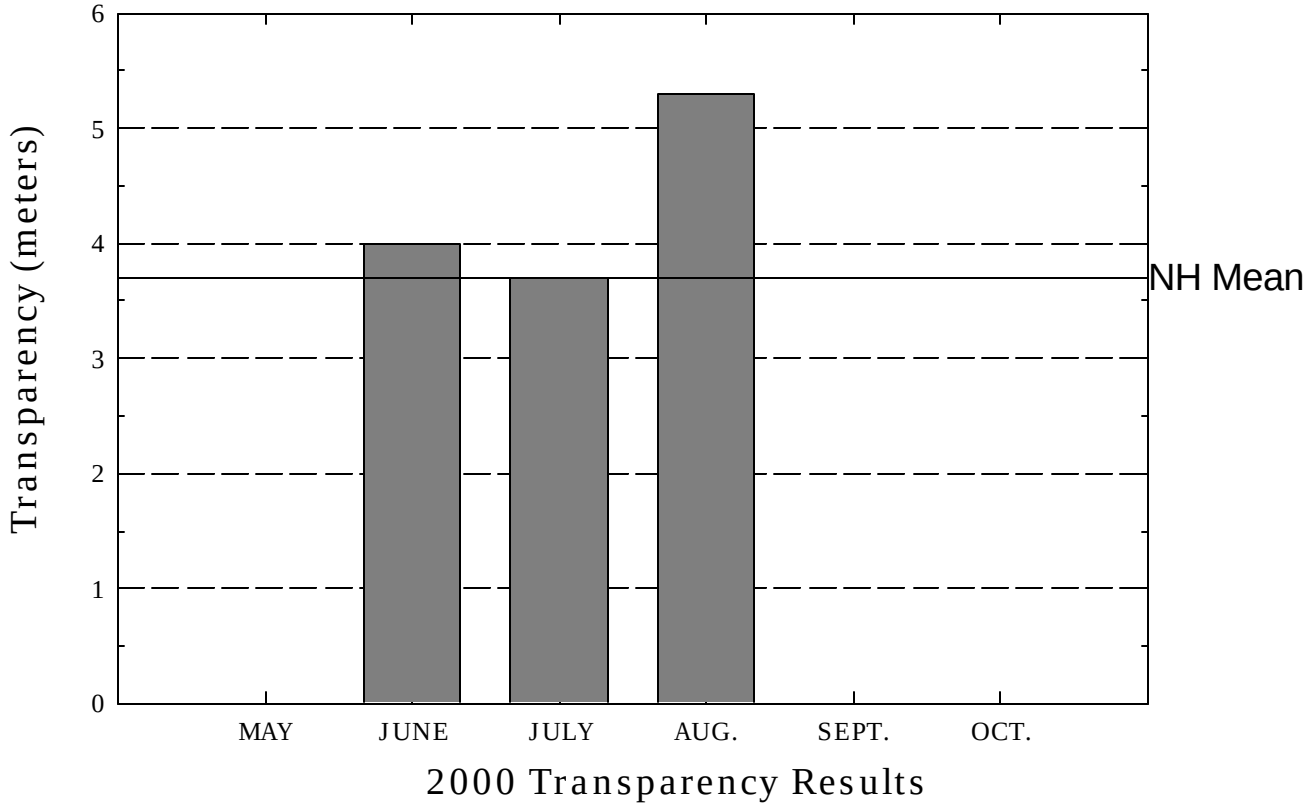
2000 Chlorophyll-a Results

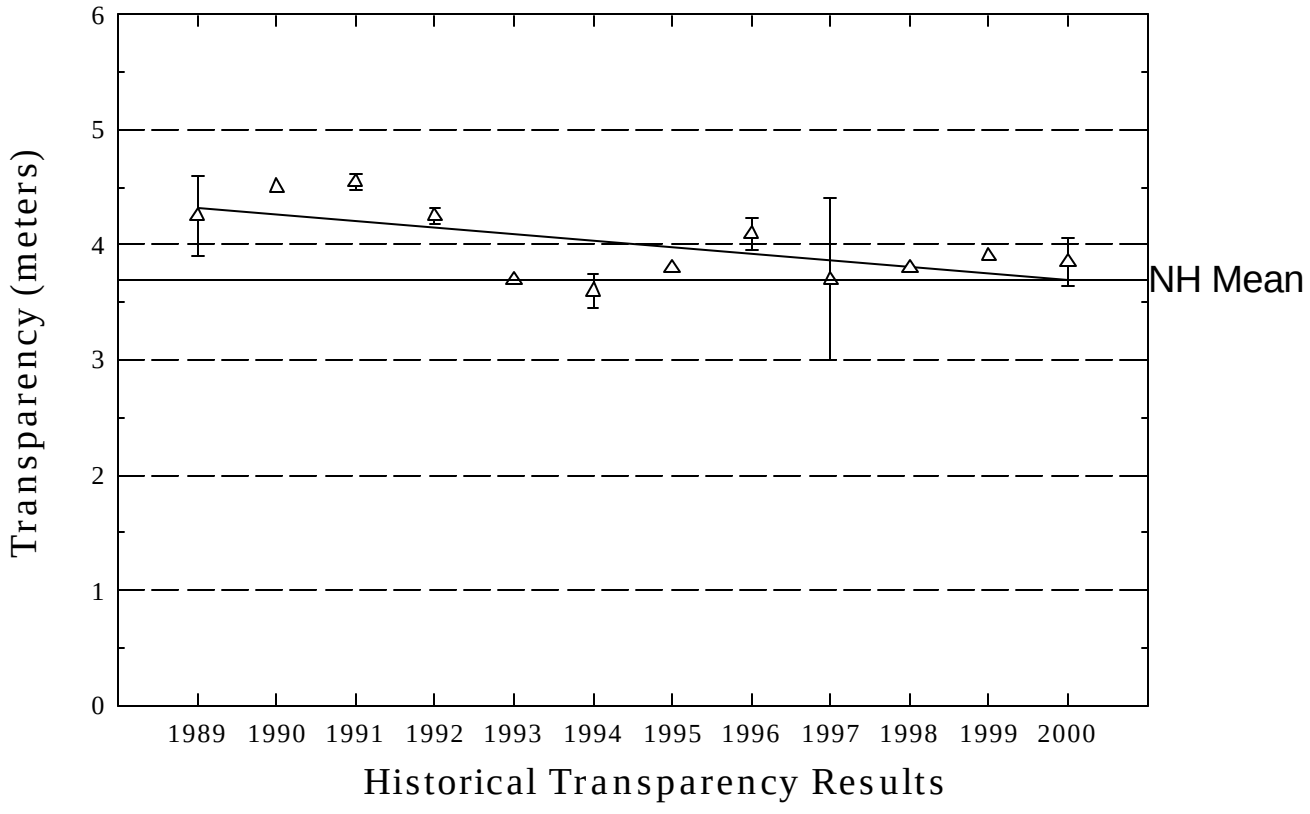


Historical Chlorophyll-a Results

Sunset Lake, Greenfield

Figure 2. Monthly and Historical Transparency Results





Sunset Lake, Greenfield

Figure 3. Monthly and Historical Total Phosphorus Data.

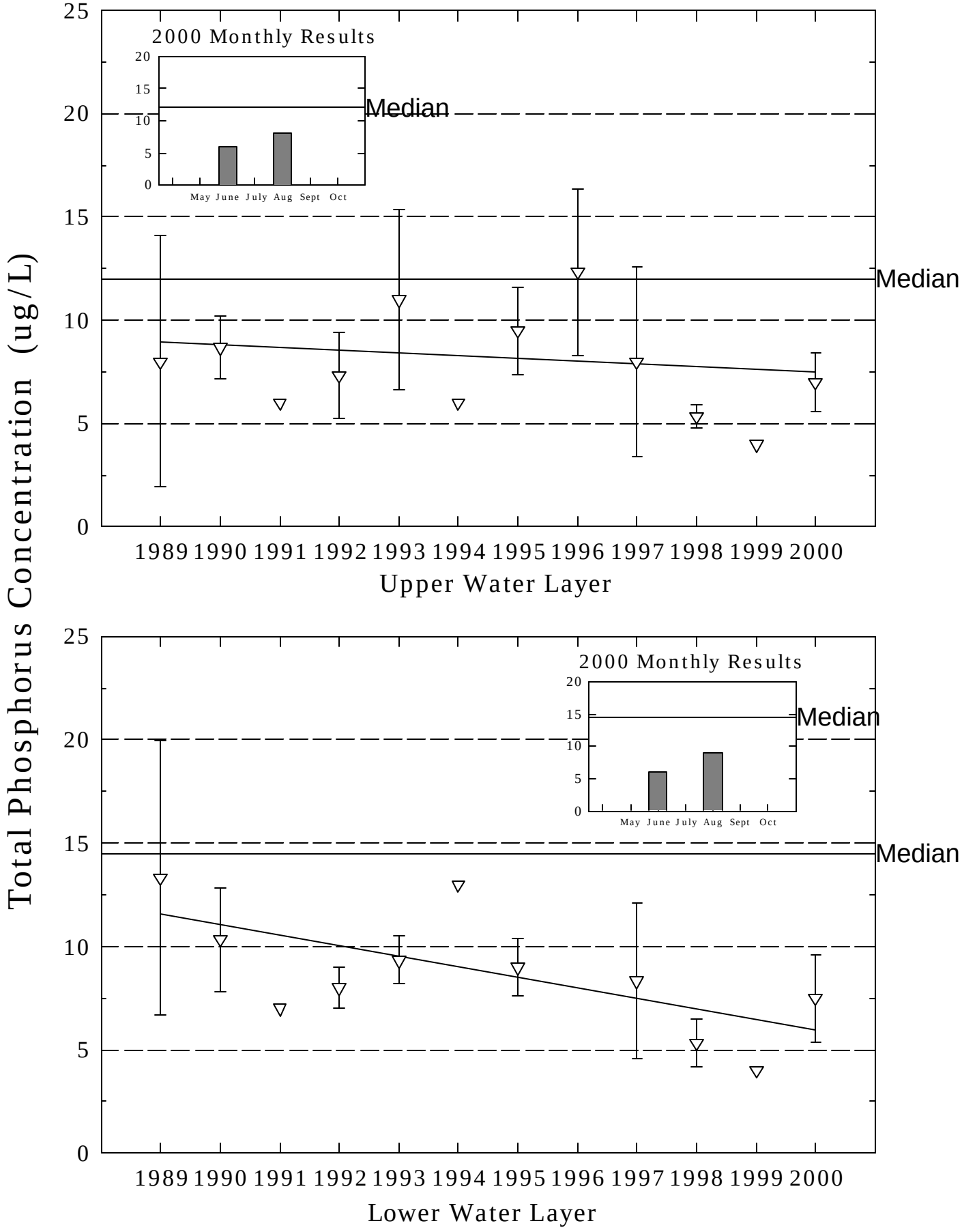


Table 1.

SUNSET LAKE

GREENFIELD

Chlorophyll-a results (mg/m^3) for current year and historical sampling periods.

Year	Minimum	Maximum	Mean
1989	3.27	5.12	4.06
1990	3.95	6.56	5.02
1991	2.00	2.73	2.36
1992	3.60	6.73	5.50
1993	2.73	6.16	4.04
1994	2.89	2.96	2.92
1995	2.16	9.61	5.88
1996	2.75	6.05	4.58
1997	2.73	6.99	5.54
1998	1.82	4.55	2.85
1999	8.04	8.04	8.04
2000	1.83	3.38	2.49

Table 2.

SUNSET LAKE

GREENFIELD

Phytoplankton species and relative percent abundance.

Summary for current and historical sampling seasons.

Date of Sample	Species Observed	Relative % Abundance
06/30/1989	DINOBRYON	42
	ASTERIONELLA	
	CHRYSOSPHAERELLA	
07/06/1990	DINOBRYON	79
06/21/1991	CHRYSOSPHAERELLA	35
	SYNEDRA	25
	ASTERIONELLA	22
06/19/1992	DINOBRYON	64
	ASTERIONELLA	23
	CHRYSOSPHAERELLA	8
06/13/1993	DINOBRYON	76
07/10/1994	RHIZOSOLENIA	24
	EUDORINA	24
	DINOBRYON	23
06/07/1995	ASTERIONELLA	87
	RHIZOSOLENIA	6
	MOUQEOTIA	4
06/25/1996	MELOSIRA	48
	DINOBRYON	36
	ASTERIONELLA	7
06/27/1997	SYNEDRA	36
	ASTERIONELLA	27
	GYMNODINIUM	18
09/01/1998	CHYSOSPHAERELLA	51
	MICROCYSTIS	48
	MOUGEOTIA	1
07/02/1999	CHRYSOSPHAERELLA	65
	RHIZOSOLENIA	19
	CYCLOTELLA	4

Table 2.

SUNSET LAKE

GREENFIELD

Phytoplankton species and relative percent abundance.

Summary for current and historical sampling seasons.

Date of Sample	Species Observed	Relative % Abundance
06/21/2000	DINOBRYON	71
	TABELLARIA	22
	RHIZOSOLENIA	3

Table 3.

SUNSET LAKE

GREENFIELD

Summary of current and historical Secchi Disk transparency results (in meters).

Year	Minimum	Maximum	Mean
1989	4.0	4.5	4.1
1990	3.7	4.5	4.0
1991	4.5	4.6	4.5
1992	3.5	4.3	4.0
1993	3.0	3.7	3.3
1994	3.5	3.7	3.6
1995	3.2	3.8	3.5
1996	3.8	4.2	4.0
1997	2.2	4.2	3.2
1998	3.8	4.0	3.8
1999	3.8	3.9	3.8
2000	3.7	5.3	4.3

Table 4.

SUNSET LAKE

GREENFIELD

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
EAST END				
	1993	7.24	7.24	7.24
EPILIMNION				
	1989	6.86	7.08	6.98
	1990	6.72	7.12	6.93
	1991	6.97	6.97	6.97
	1992	6.94	7.17	7.05
	1993	6.87	7.32	7.10
	1994	6.57	6.98	6.73
	1995	6.87	6.92	6.89
	1996	6.49	6.76	6.60
	1997	6.87	7.00	6.93
	1998	6.55	6.84	6.71
	1999	6.60	6.60	6.60
	2000	6.64	6.83	6.73
HYPOLIMNION				
	1989	6.92	7.12	6.99
	1990	6.33	7.03	6.55
	1991	7.00	7.00	7.00
	1992	4.00	6.95	4.48
	1993	6.89	7.19	7.03
	1994	6.69	6.69	6.69
	1995	6.88	6.91	6.89
	1997	6.55	6.84	6.66
	1998	6.57	6.82	6.65
	1999	6.58	6.58	6.58

Table 4.

SUNSET LAKE

GREENFIELD

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
HYPOLIMNION				
	2000	6.47	6.97	6.68
INLET				
	1989	6.91	6.91	6.91
	1992	6.44	6.74	6.56
	1993	6.67	6.67	6.67
	1994	6.15	6.15	6.15
	1995	6.71	6.71	6.71
	1996	6.15	6.15	6.15
	1998	6.57	6.57	6.57
	2000	5.79	6.12	5.98
LEFT BEACH				
	1993	7.13	7.13	7.13
METALIMNION				
	1989	6.87	6.89	6.88
OUTLET				
	1989	6.96	6.96	6.96
	1991	7.10	7.10	7.10
	1992	6.84	7.02	6.91
	1993	6.94	6.94	6.94
	1994	6.35	6.87	6.54
	1995	6.88	6.88	6.88
	1996	6.51	6.61	6.56
	1997	6.75	6.75	6.75

Table 4.

SUNSET LAKE

GREENFIELD

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
	1998	6.19	6.92	6.46
	1999	6.55	6.55	6.55
	2000	6.54	6.80	6.62
RIGHT BEACH				
	1993	7.20	7.20	7.20
WEST END				
	1993	7.12	7.12	7.12

Table 5.

SUNSET LAKE

GREENFIELD

Summary of current and historical Acid Neutralizing Capacity.
Values expressed in mg/L as CaCO .

Epilimnetic Values

Year	Minimum	Maximum	Mean
1989	5.00	5.40	5.27
1990	4.60	5.50	5.10
1991	5.90	5.90	5.90
1992	5.90	6.50	6.17
1993	6.40	6.50	6.47
1994	5.50	5.90	5.70
1995	4.80	5.00	4.90
1996	3.50	4.60	4.05
1997	5.40	6.40	5.78
1998	4.50	5.10	4.90
1999	4.00	4.00	4.00
2000	3.70	4.00	3.87

Table 6.

SUNSET LAKE
GREENFIELD

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
CMRC BEACH				
	1991	63.0	63.0	63.0
EAST END				
	1993	67.7	67.7	67.7
EPILIMNION				
	1989	58.6	60.1	59.2
	1990	59.3	60.1	59.7
	1991	62.5	62.5	62.5
	1992	64.2	66.4	65.3
	1993	65.8	68.3	67.2
	1994	73.2	74.3	73.7
	1995	77.4	78.6	78.0
	1996	78.7	88.0	83.3
	1997	79.3	85.2	81.8
	1998	87.7	92.4	90.1
	1999	104.1	104.1	104.1
	2000	105.8	120.6	115.4
HYPOLIMNION				
	1989	57.8	59.0	58.5
	1990	59.5	59.8	59.6
	1991	62.1	62.1	62.1
	1992	64.6	66.5	65.7
	1993	65.6	68.1	66.6
	1994	73.1	73.1	73.1
	1995	77.1	83.7	80.4

Table 6.

SUNSET LAKE
GREENFIELD

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
	1997	79.5	80.0	79.7
	1998	90.7	91.7	91.1
	1999	102.8	102.8	102.8
	2000	115.2	120.1	118.4
INLET				
	1989	59.4	59.4	59.4
	1992	78.7	79.6	79.1
	1993	77.6	77.6	77.6
	1994	79.4	79.4	79.4
	1995	99.5	99.5	99.5
	1996	103.6	103.6	103.6
	1998	65.3	65.3	65.3
	2000	198.6	264.0	227.2
LEFT BEACH				
	1993	67.8	67.8	67.8
METALIMNION				
	1989	59.1	59.6	59.3
OUTLET				
	1989	59.3	59.3	59.3
	1991	63.1	63.1	63.1
	1992	64.2	73.0	67.6
	1993	65.7	65.7	65.7
	1994	72.8	74.5	73.6
	1995	77.3	77.3	77.3
	1996	78.9	81.3	80.1
	1997	81.5	81.5	81.5

Table 6.

SUNSET LAKE
GREENFIELD

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
	1998	87.1	91.5	89.8
	1999	103.8	103.8	103.8
	2000	109.1	120.4	116.4
PUBLIC BEACH				
	1991	77.0	77.0	77.0
RIGHT BEACH				
	1993	67.5	67.5	67.5
WEST END				
	1993	72.7	72.7	72.7

Table 8.

SUNSET LAKE

GREENFIELD

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
EAST END				
	1993	9	9	9
EPILIMNION				
	1989	1	12	8
	1990	7	10	8
	1991	6	6	6
	1992	5	9	7
	1993	8	16	11
	1994	6	6	6
	1995	8	11	9
	1996	8	16	12
	1997	3	12	8
	1998	5	6	5
	1999	4	4	4
	2000	6	8	7
HYPOLIMNION				
	1989	9	21	13
	1990	8	13	10
	1991	7	7	7
	1992	7	9	8
	1993	8	10	9
	1994	13	13	13
	1995	8	10	9
	1997	4	11	8
	1998	4	6	5
	1999	4	4	4

Table 8.

SUNSET LAKE

GREENFIELD

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
	2000	6	9	7
INLET				
	1989	10	10	10
	1992	38	46	42
	1993	19	19	19
	1995	10	10	10
	1996	14	14	14
	1998	2	2	2
	2000	8	17	12
LEFT BEACH				
	1993	12	12	12
METALIMNION				
	1989	10	11	10
OUTLET				
	1989	1	1	1
	1991	8	8	8
	1992	6	15	10
	1993	9	9	9
	1994	9	9	9
	1995	7	7	7
	1996	7	8	7
	1997	11	11	11
	1998	3	6	4
	1999	5	5	5
	2000	5	8	6

Table 8.

SUNSET LAKE

GREENFIELD

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
RIGHT BEACH				
	1993	13	13	13
WEST END				
	1993	17	17	17

Table 10.

SUNSET LAKE

GREENFIELD

Historic Hypolimnetic dissolved oxygen and temperature data.

Date	Depth (meters)	Temperature (celsius)	Dissolved Oxygen (mg/L)	Saturation (%)
June 30, 1989	6.0	14.0	11.2	108.0
June 21, 1991	5.0	21.0	6.9	77.9
June 19, 1992	4.0	21.0	8.5	95.9
June 13, 1993	3.5	18.5	12.1	128.0
July 10, 1994	3.5	25.2	9.6	115.0
June 7, 1995	3.5	19.5	9.6	102.0
June 25, 1996	4.0	21.3	7.3	81.0
June 27, 1997	4.0	22.0	9.6	109.0
September 1, 1998	4.0	23.8	7.6	88.0
July 2, 1999	4.0	24.2	5.6	67.1

Table 11.

SUNSET LAKE
GREENFIELD

Summary of current year and historic turbidity sampling.
Results in NTU's.

Station	Year	Minimum	Maximum	Mean
EAST END				
	1993	0.0	0.0	0.0
EPILIMNION				
	1993	0.0	0.0	0.0
	1997	0.2	0.7	0.5
	1998	0.3	0.5	0.4
	1999	0.4	0.4	0.4
	2000	0.2	0.3	0.3
HYPOLIMNION				
	1993	0.0	0.0	0.0
	1997	0.5	0.7	0.6
	1998	0.5	0.6	0.5
	1999	0.4	0.4	0.4
	2000	0.2	0.3	0.3
INLET				
	1998	0.6	0.6	0.6
	2000	0.3	4.0	2.7
OUTLET				
	1997	0.3	0.3	0.3
	1998	0.2	0.6	0.4
	1999	0.8	0.8	0.8
	2000	0.2	0.4	0.2
WEST END				
	1993	0.0	0.0	0.0

Table 12.

SUNSET LAKE

GREENFIELD

Summary of current year bacteria sampling.
Results in counts per 100ml.

Location	Date	E. Coli See Note Below
BEACH		
	June 21	< 10

NOTE: "<" means "less than" and ">" means "greater than"